(12) UK Patent Application (19) GB (11) 2 341 017 (13) A

(43) Date of A Publication 01.03.2000

(21) Application No 9818513.5

(22) Date of Filing 25.08.1998

(71) Applicant(s)
George Alan Limpkin
22 Haynes Mead, Chiltern Park, BERKHAMSTEAD, Herts, HP4 1BU, United Kingdom

Timothy Connolly
The Briars, Kingsway, HULLBRIDGE, Essex, SS5 6DR, United Kingdom

John Peter Stephenson
Kites, Dry Arch Road, SUNNINGDALE, Berks, SL5 0DB, United Kingdom

(72) Inventor(s)
George Alan Limpkin
Timothy Connolly
John Peter Stephenson

(74) Agent and/or Address for Service
Lloyd Wise, Tregear & Co
Commonwealth House, 1-19 New Oxford Street, LONDON, WC1A 1LW, United Kingdom

(51) INT CL[7]
H05B 37/04 41/46

(52) UK CL (Edition R)
H2H HB8 HLL2 H25Q
G1A AA1 AG6 AG9 AMSX AR7
H2E ECHU
U1S S2286

(56) Documents Cited

GB 2287309 A	GB 2175386 A	GB 2110486 A
GB 1101523 A	EP 0396791 A1	EP 0239653 A1
EP 0196249 A1	US 5570947 A	US 5349508 A
US 5221139 A	US 5088015 A	US 4906888 A
US 4527095 A	US 3999099 A	US 3790846 A

(58) Field of Search
UK CL (Edition Q) F4R RGA RL RMR, G1A AMSV AMSX, H2H HLL2 HLV5
INT CL[6] F21S 3/00 3/02, F21V 19/00 21/00, H01J 61/02, H05B 37/03 37/04 39/10 41/46
ONLINE - EPODOC, WPI

(54) Abstract Title
Substituting defective light sources

(57) If a sensor 16 detects that a primary lamp 14 is exhibiting a predetermined characteristic, or combination of characteristics, indicative of substantial deterioration or failure, a secondary lamp 15 is substituted for lamp 14. The output of sensor 16 is monitored with a time delay, and if after this timed period a lamp fault is indicated, power to lamp control gear 12 is removed, a switching circuit 11 switches over output connections to secondary lamp 15, and then after a preset time power is reapplied to control gear 12 to turn on lamp 15. There may be multiple primary and secondary lamps, for example in an advertising sign. A primary lamp may be associated with multiple secondary lamps in a unitary lamp assembly (Figs. 15-17), a first secondary lamp becoming operative when the primary lamp fails, then a further secondary lamp being operative when the first secondary lamp fails, and so on. Primary and secondary control gear 12 may also be provided to improve reliability. Lamp failure may be detected by sensing light output with an LDR, or by sensing lamp voltage, current or temperature (Figs.6-8), or by sensing blackening of the lamp. Lamp status indicating LED's may be provided (Fig.9), and remote monitoring may be provided by via a radio or infra-red transmitter, or via a modem and phone line, (Figs. 10-12). A secondary lamp test function, and battery backup are further options.

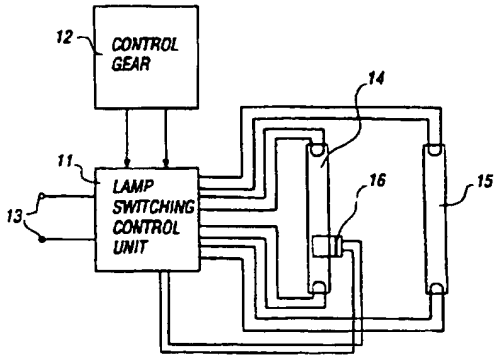

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

GB 2 341 017 A

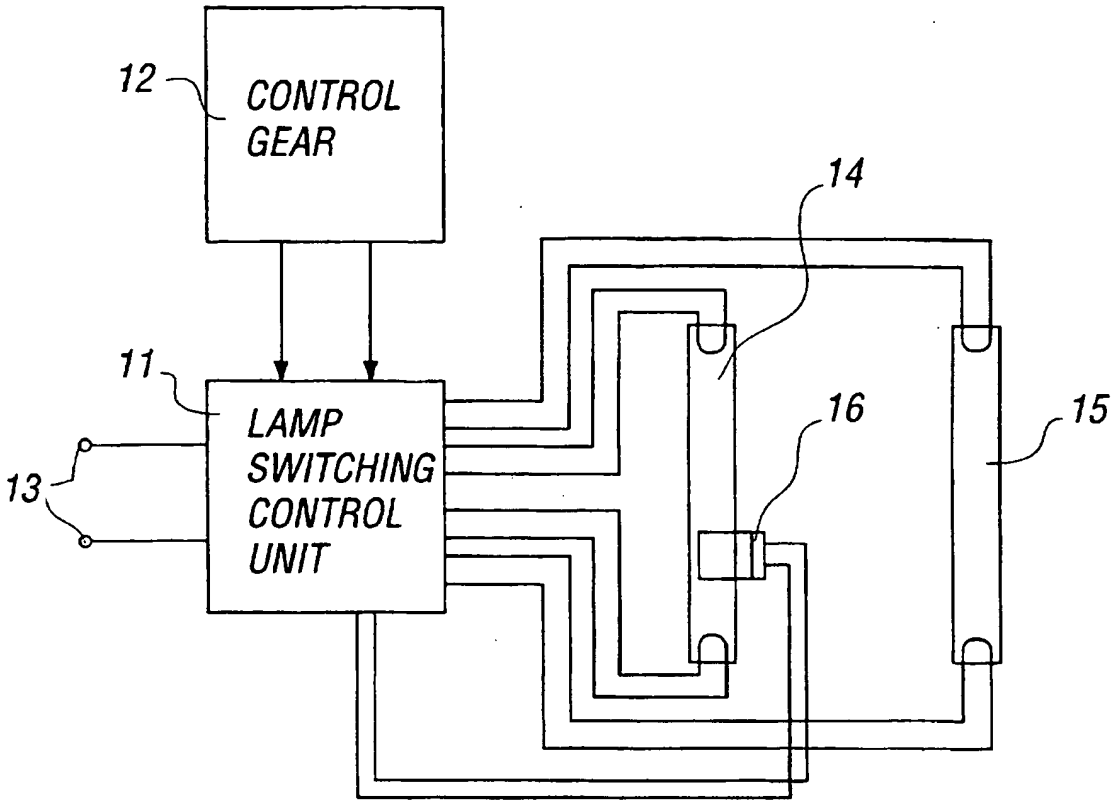
12
CONTROL GEAR
14
11
LAMP SWITCHING CONTROL UNIT
16
15
13

FIG. 1

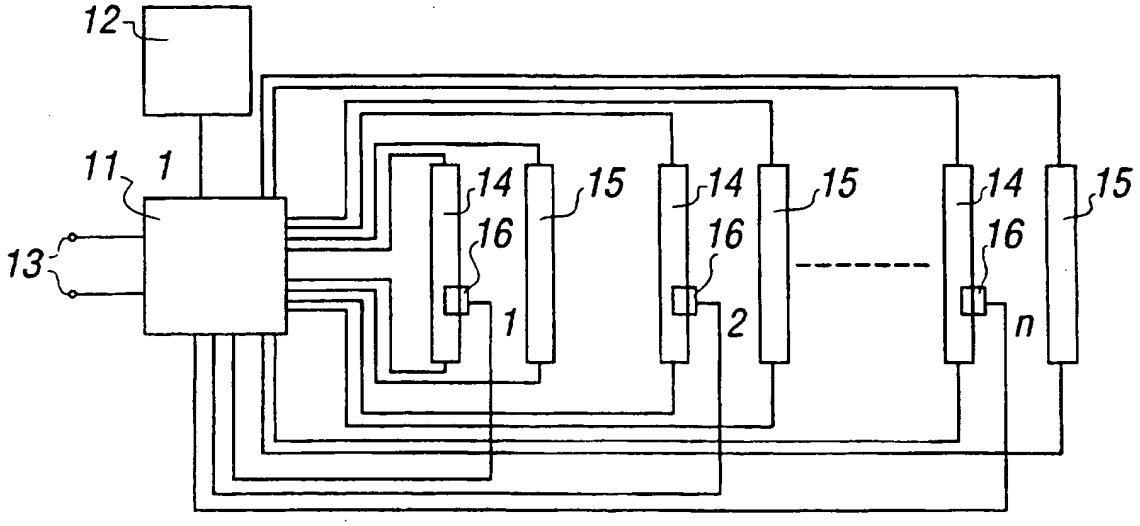
12
11
1
13
14
15
16
1
2
n

FIG. 2

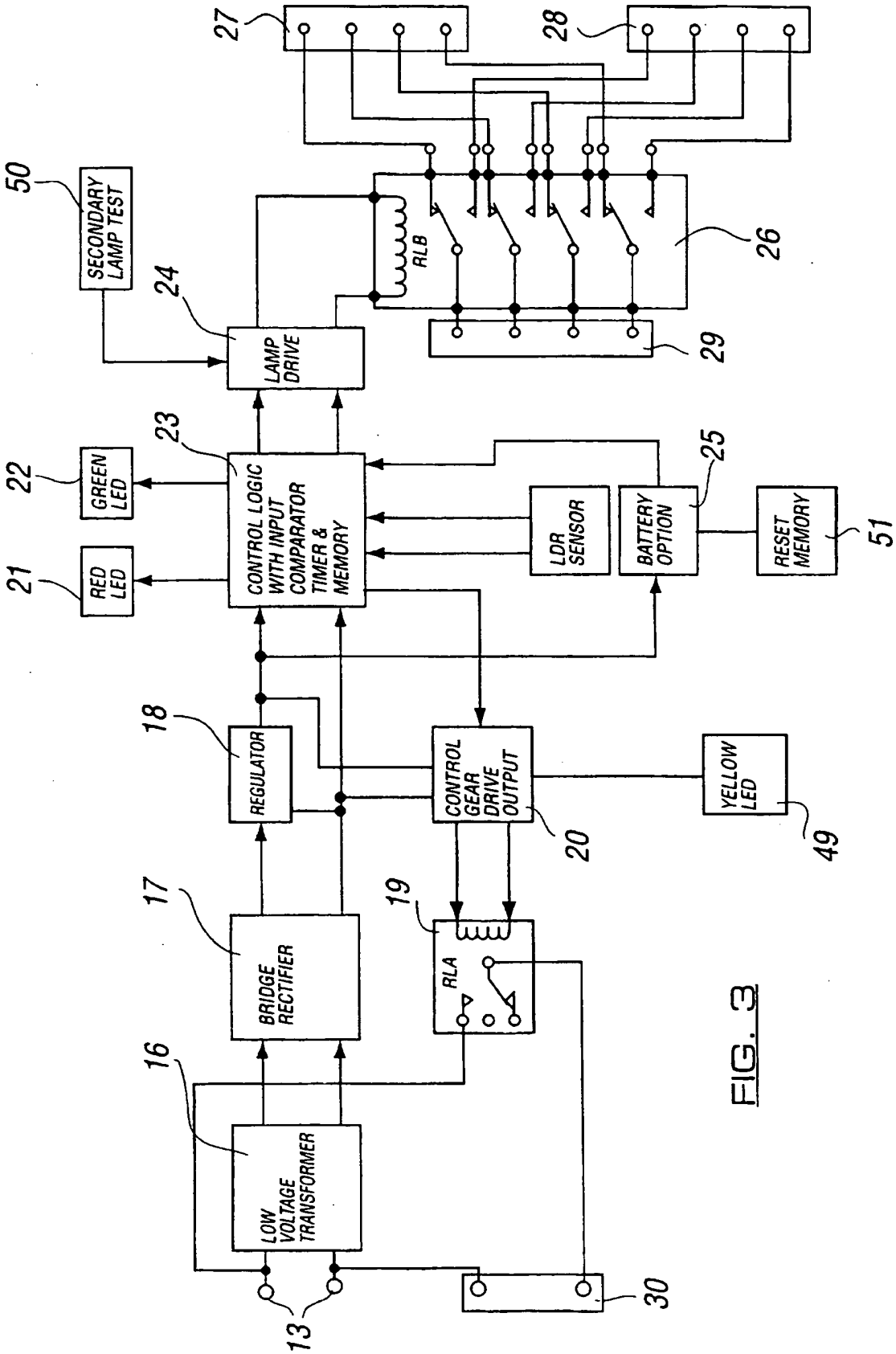
27
28
50
SECONDARY LAMP TEST
RLB
26
24
LAMP DRIVE
29
23
22
GREEN LED
CONTROL LOGIC WITH INPUT COMPARATOR TIMER & MEMORY
LDR SENSOR
BATTERY OPTION
25
RESET MEMORY
51
21
RED LED
18
REGULATOR
CONTROL GEAR DRIVE OUTPUT
YELLOW LED
20
49
17
BRIDGE RECTIFIER
19
RLA
16
LOW VOLTAGE TRANSFORMER
13
30

FIG. 3

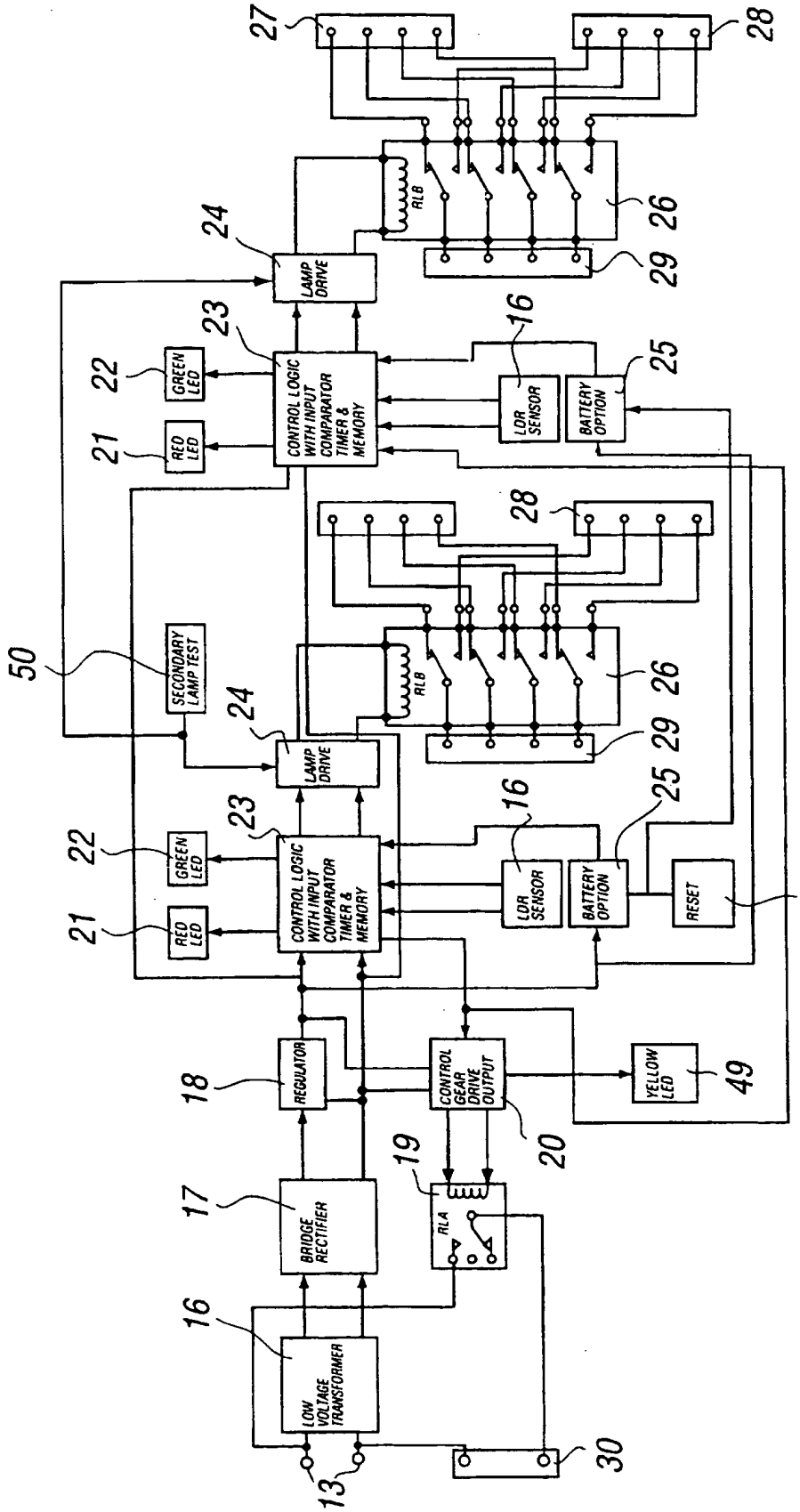
27
28
RLB
26
29
24
LAMP DRIVE
23
16
22
GREEN LED
CONTROL LOGIC WITH INPUT COMPARATOR TIMER & MEMORY
LDR SENSOR
BATTERY OPTION
25
21
RED LED
50
SECONDARY LAMP TEST
RESET
51
18
REGULATOR
CONTROL GEAR DRIVE OUTPUT
YELLOW LED
49
20
19
17
BRIDGE RECTIFIER
RLA
LOW VOLTAGE TRANSFORMER
13
30

FIG. 4

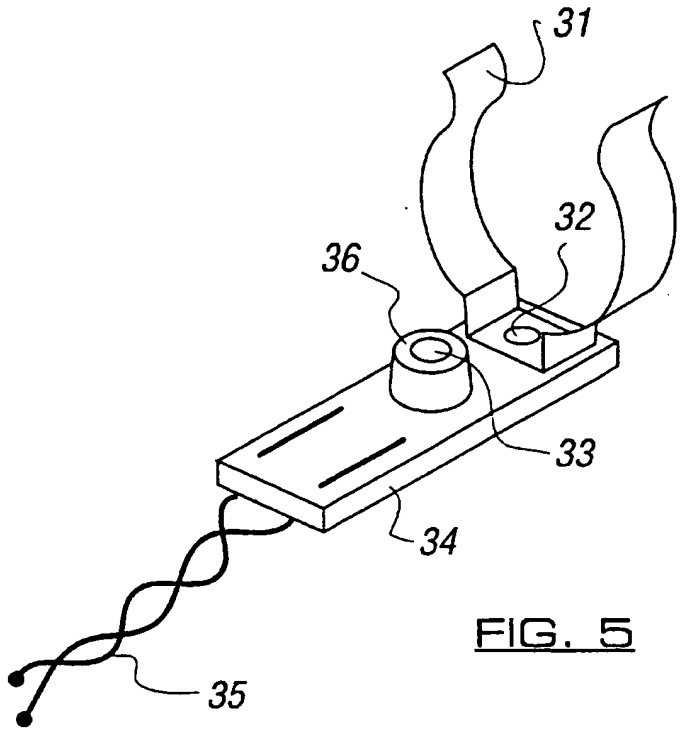

FIG. 5

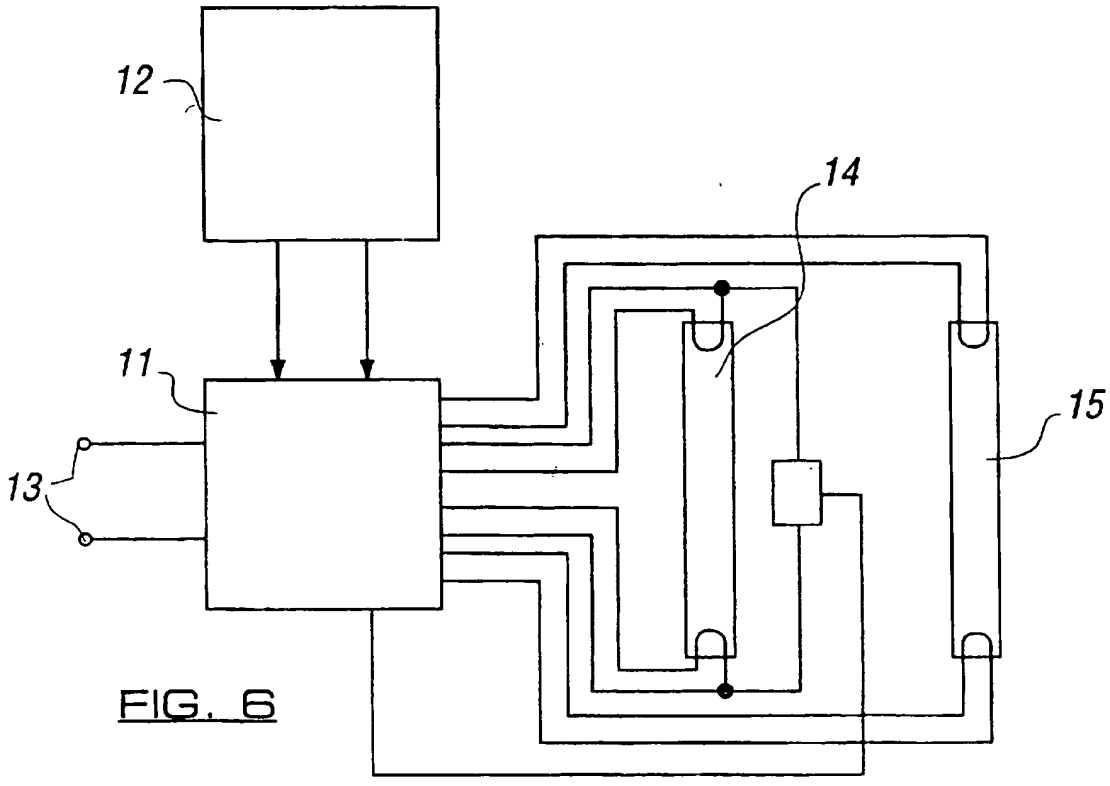

FIG. 6

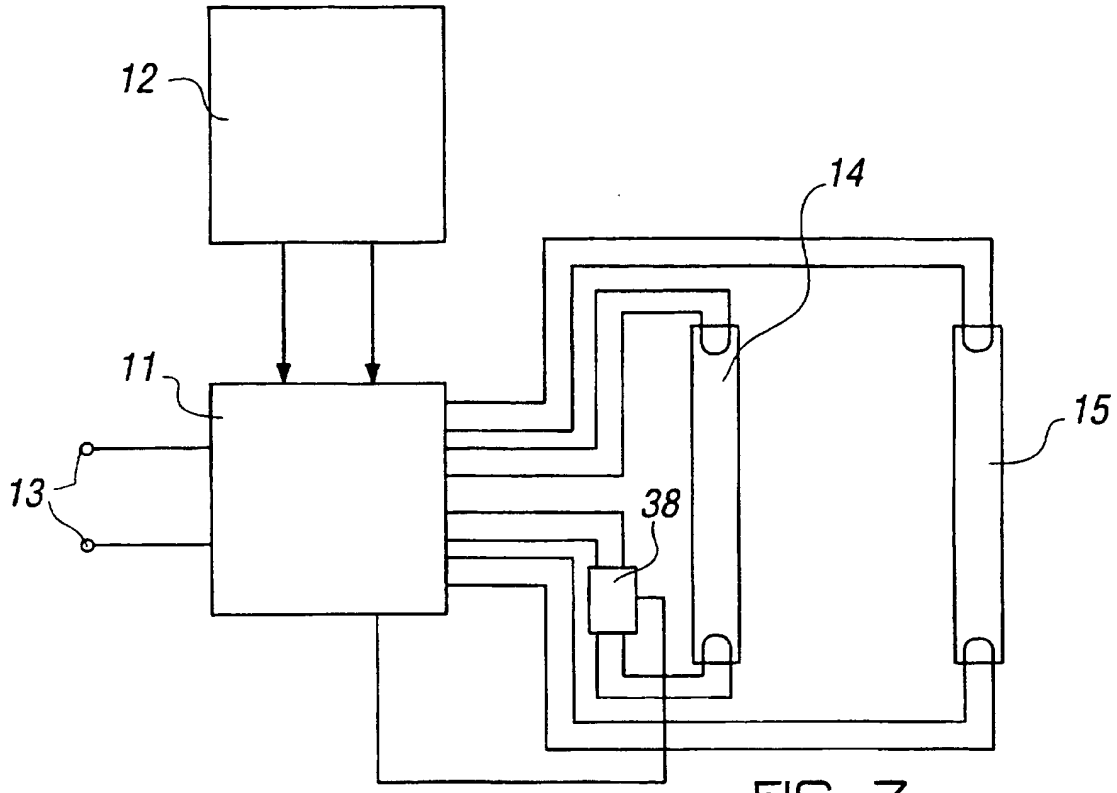

FIG. 7

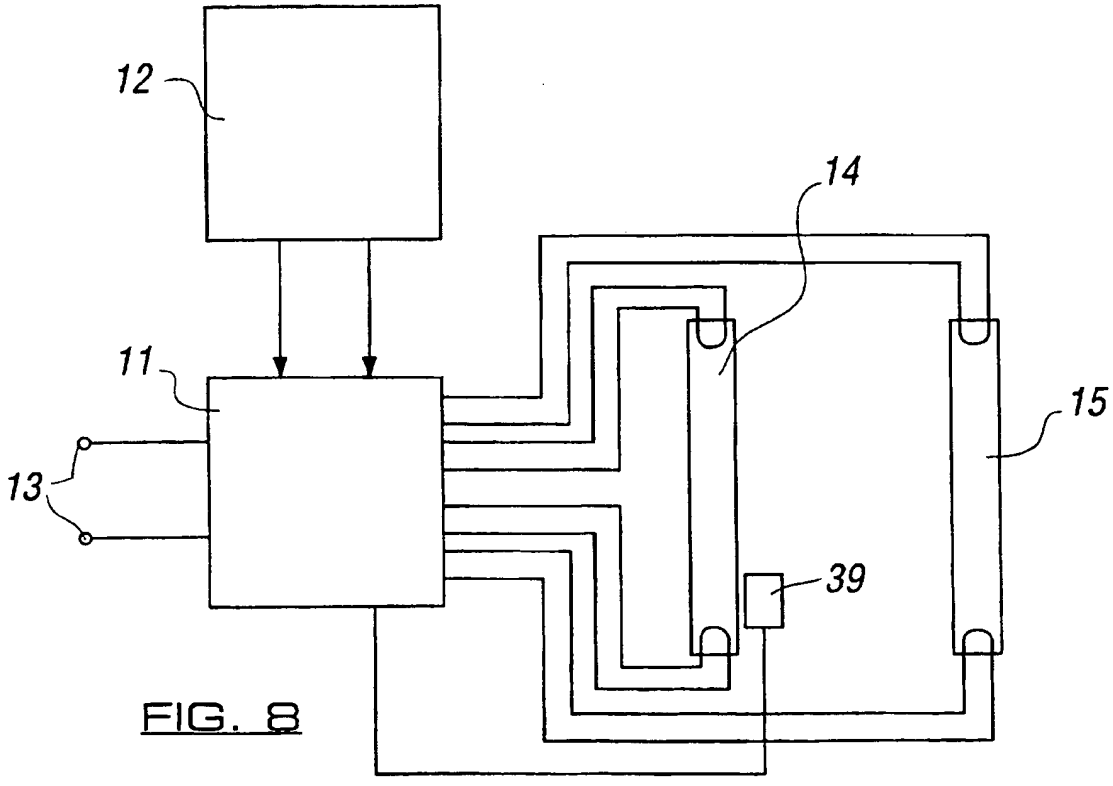

FIG. 8

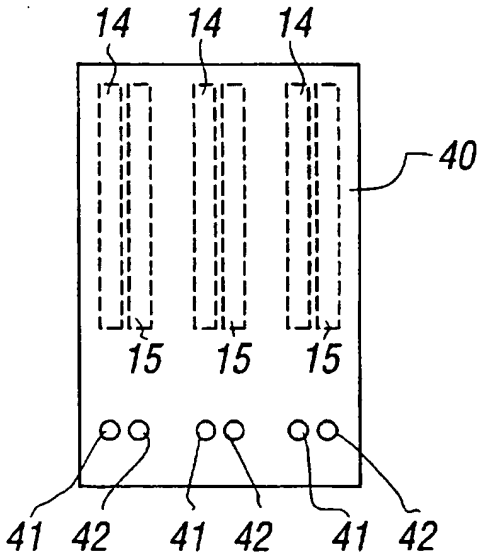

FIG. 9

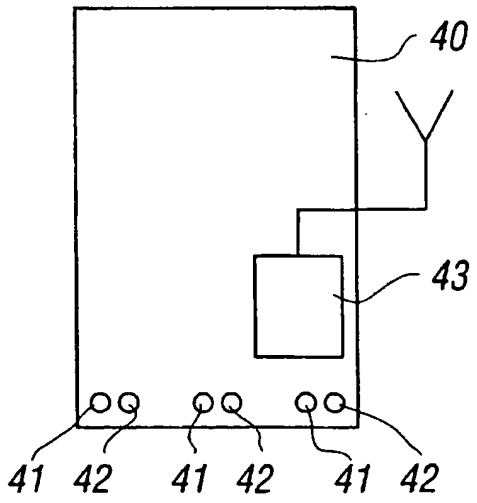

FIG. 10

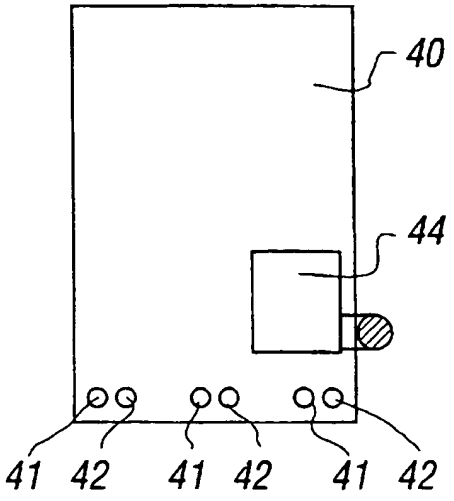

FIG. 11

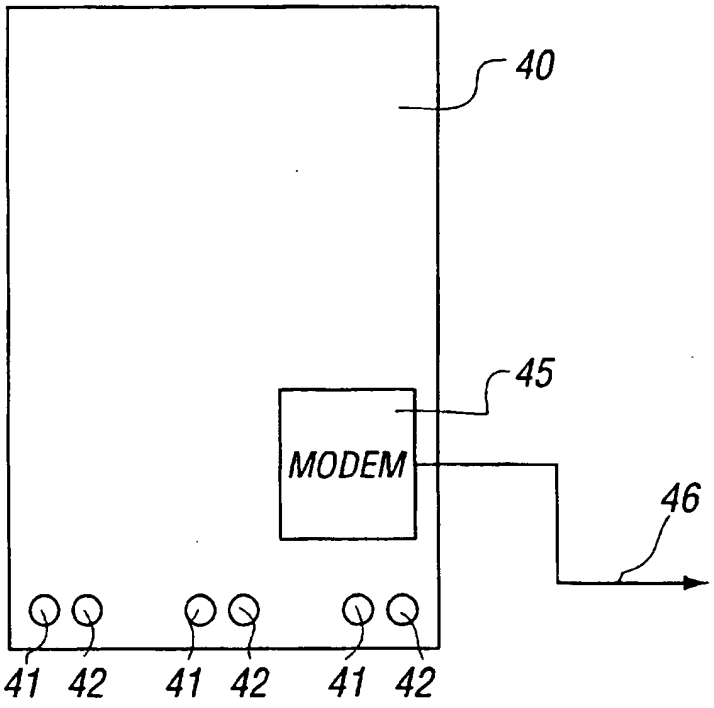
40
45
MODEM
46
41
42
41
42
41
42

FIG. 12

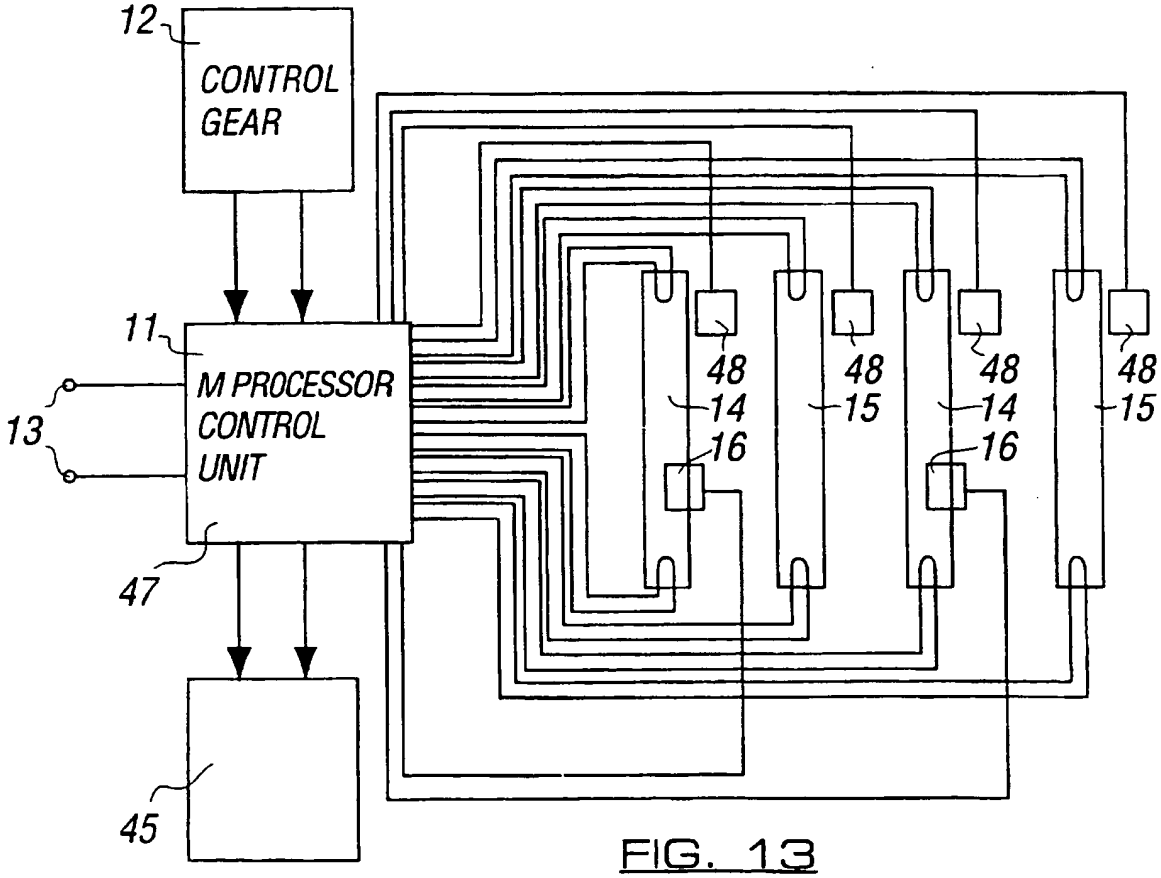
12
CONTROL GEAR
11
M PROCESSOR CONTROL UNIT
13
47
45
48
14
16
15
48
15
48
14
16
48

FIG. 13

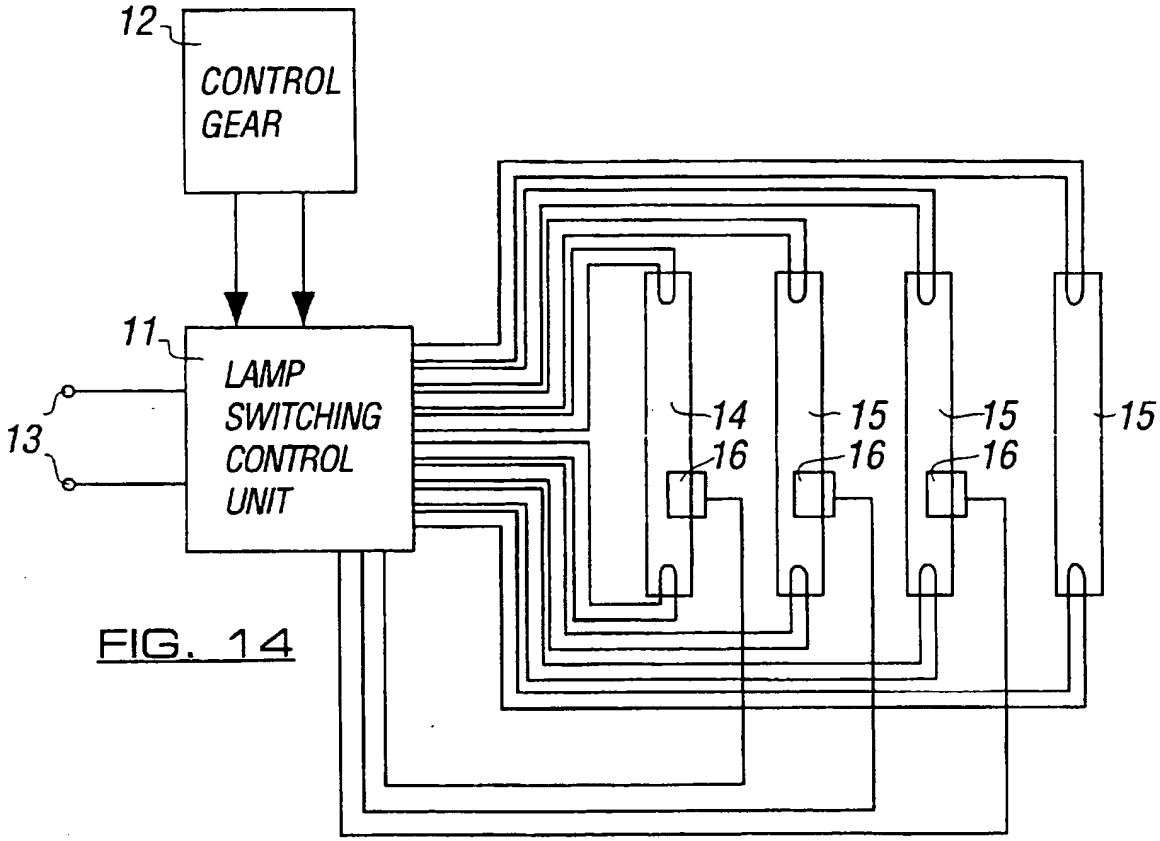

FIG. 14

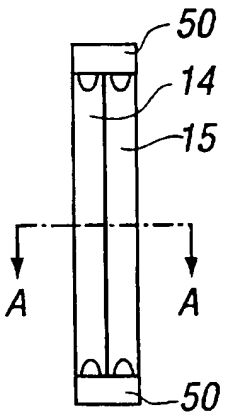

FIG. 15

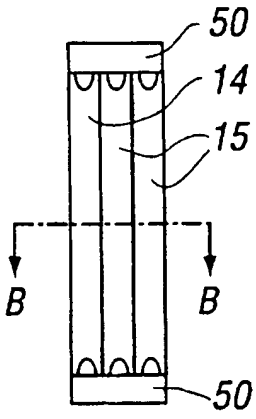

FIG. 16

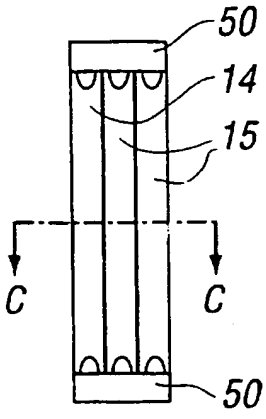

FIG. 17

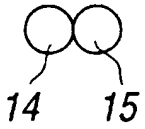

FIG. 15A

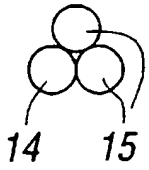

FIG. 16A

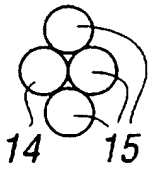

FIG. 17A

IMPROVEMENTS IN LIGHTING

The present invention relates to the control of lighting units, and more particularly, to improving the reliability of such units.

All lamps, whether fluorescent, incandescent, or another type, have a finite lifespan. Lighting unit maintenance to replace failed lamps is often costly, especially when the lamps are not readily accessible, for example in a wall mounted advertising sign or in buildings using large numbers of lamps.

There are also several situations where lamp failure is particularly undesirable or even hazardous. Luminaires for emergency lighting of escape routes include only one lamp as they run on a relatively low power reserve battery when mains power fails. Lamp failure could be a serious hazard to life if the only lamp fails in an emergency evacuation of a building. Also, colour recognition inspection in a manufacturing environment such as the pharmaceuticals industry may be impaired if a lamp fails. Furthermore, in the illuminated sign industry, there is a need to avoid lamp failure as this may cause poor image display. Advertisers may financially penalise companies selling advertising space in the event that illumination of a sign fails.

However, it is difficult to predict lamp failure. Failure prediction charts issued by lamp companies deal only with probability rates of failure. An example is that a fluorescent lamp officially rated at 16,000 hours is so rated because after 16,000 hours, 50% of lamps of such a rated category will have failed. However, some lamps fail after a few hundred hours and with the above category of lamps, 5% statistically will fail after only 3,000 hours. Lamp failure is affected by a number of factors, such as the number of hours of usage, supply voltage variations, how often the lamp is switched on and off, the quality control applied by the manufacturers, and the temperatures to which the lamp is exposed.

According to the invention, lamp control circuitry comprises input means for connection to a power supply, control means, first and second output means for connection to first and

second lamps, respectively, and a sensor for monitoring said first lamp, such that when or after the sensor detects that said first lamp is exhibiting a predetermined characteristic indicative of substantial deterioration or failure, the control means switches power output from the first to the second output means. With such an arrangement, it is possible to extend the operating life of a lighting unit. The lighting unit is able to continue to function properly despite the failure or deterioration of a lamp.

The predetermined characteristic detected by the sensor is preferably the light output of said first lamp falling below a threshold level. In this embodiment, the sensor may be a light dependent resistor (LDR). Preferably, a shroud is provided around the sensor to ensure that light is substantially only incident on the sensor from said first lamp. Thus, the effect of other light sources and ambient light can be minimised. In addition, means may be provided for releasably attaching the sensor to said first lamp. Accordingly, when the first lamp is replaced, the sensor may be readily detached from the old lamp and attached to its replacement.

In another preferred embodiment, the predetermined characteristic is a predetermined voltage level across the terminals of said first lamp. Alternatively, it may be a particular value of the current drawn by said first lamp. In a further preferred embodiment, the predetermined characteristic is a predetermined temperature threshold for the lamp. In yet another embodiment, the lamp is a fluorescent lamp, and the characteristic is a predetermined degree of blackening on the inner surface of the lamp adjacent one of its electrodes. During use of a fluorescent lamp, its electrodes are gradually eroded, and some eroded material is deposited on the inner surface of the lamp.

Furthermore, the characteristic may be a predetermined combination of two or more of the characteristics referred to above. Each of the characteristics can be indicative of the remaining life or deterioration of a lamp and the accuracy of the monitoring of the lamp may be improved by sensing a particular

combination of factors.

The circuitry may include a status indicator to show when power output has been switched from the first to the second output means. Accordingly, it may be possible to readily determine whether the first lamp requires replacement. The status indicator may be an LED for example. Alternatively, status information may be transmissible to a monitoring station via a modem link, an infra-red link or via a radio transmission, for example.

In another preferred configuration, the circuitry may comprise separate sets of electrical components for controlling the current fed to each lamp, power being deliverable to each lamp via the respective set. Accordingly, if deterioration or failure of the output of the first lamp is due to deterioration of failure of the respective set of components, the second lamp should still be able to function properly.

The circuitry may further include three or more output means for connection to respective lamps, and sensors for monitoring all but the last of said lamps, the control means being operable to switch power from one output means to the next after the sensor associated with the lamp connected to the one output means detects that it is exhibiting a predetermined characteristic, as discussed above.

In accordance with another aspect of the invention, a unitary lamp assembly comprises first and second lamps fixed together and connectable to the first and second output means, respectively, of the circuitry defined above. Such an assembly enables both lamps to be replaced simultaneously, thereby increasing the efficiency of the replacement process.

According to a further aspect of the invention, a unitary lamp assembly comprises control circuitry as defined above, and first and second lamps connected to first and second output means, respectively, of the circuitry. This assembly could be fitted in place of a conventional single lamp to provide the benefits discussed above in an existing lighting unit.

Most fluorescent lamps in medium to large companies are changed on failure by specialised maintenance companies or by a

local electrical contractor. In either case, the cost of a lamp change would not be less than £25. In consequence, a common and growing practice is to change all the fluorescent lamps after a period of time when it is estimated that a given proportion of lamps will have failed. This period may vary from 2-3 years, according to operating conditions. Use of the circuitry of the present invention would double this change interval. In the example quoted above, 50% of the lamps would not fail at 16,000 hours but would run on to 24,000 hours plus.

Accordingly, the invention provides an improvement in employees' safety, improvements in the operation of continuous production processes and similar operations and cost benefits in maintenance contracts in all installations.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings wherein:

Figure 1 shows a block diagram of control circuitry of the invention;

Figure 2 shows a layout of a multiple lamp sign or luminaire;

Figure 3 shows a block diagram of an electronic control unit for single lamp operation;

Figure 4 shows a block diagram of the electronic control unit for multiple lamp operation;

Figure 5 shows a clip-on solid state sensor unit;

Figure 6 shows a monitoring system using voltage sensing;

Figure 7 shows a monitoring system using current sensing;

Figure 8 shows a monitoring system using temperature sensing;

Figure 9 shows a sign or luminaire including status indicators;

Figure 10 shows a sign or luminaire comprising a radio transmitter;

Figure 11 shows a sign or luminaire comprising an infra-red transmitter;

Figure 12 shows a sign or luminaire comprising a telephone modem line;

Figure 13 shows microprocessor-based control circuitry for monitoring lamp status;

Figure 14 shows a multiple lamp monitoring system;

Figures 15, 16 and 17 show unitary lamp assemblies including two, three and four lamps, respectively; and

Figures 15A, 16A and 17A show cross-sectional views along line A-A in Figure 15, line B-B in Figure 16 and line C-C in Figure 17, respectively.

Figure 1 shows a block diagram of lamp control circuitry. A lamp switching control unit 11 is supplied from a mains voltage input 13. In normal operation, the mains input 13 is connected to the primary lamp 14 via control gear 12, and not a secondary lamp 15. In the illustrated circuitry, the lamps 14 and 15 are fluorescent lamps and the control gear 12 is either high frequency control or switch start circuitry.

The primary lamp 14 is continuously monitored by an LDR sensor 16. If the primary lamp 14 fails or its light output falls below a predetermined level, then this is detected by the LDR sensor 16 which is connected to the lamp switching control unit 11. This will remove the power supply to control gear 12 and switch over all the lamp connections to the secondary lamp 15. After a preset time power is then reapplied to the control gear 12 which in turn switches on the secondary lamp 15.

The system of Figure 1 can be extended for multiple lamp operation is shown in Figure 2. This shows multiple primary lamps 14, numbered from 1 to n, each with an LDR sensor 16 and a corresponding secondary lamp 15.

Figure 3 shows the block diagram of the electronic control unit 11 of Figure 1. Power applied to the input of the low voltage transformer 16. Its output is rectified by a bridge rectifier 17 and put into a fixed regulator 18 which provides a regulated supply for the control logic unit 23. Under normal control, the control gear drive output 20 powers the relay RLA 19 to provide a power supply input 30 to the control gear 12. The output of the control gear 12 is connected to the input 29 of the lamp switching relay RLB 26. This connects the control gear to the primary lamp 14 through the output connections 27.

In normal operation, the yellow LED 49 operates to show that power has been applied to the control gear 12 and the LDR sensor 16 continuously monitors the primary lamp 14. The control logic unit 23 compares a reference value against the measured LDR sensor 16 input. If this changes due to primary lamp failure or reduced light output, the output of the internal comparator of the control logic unit 23 produces an output which is monitored with a time delay. If after this timed period the comparator output indicates lamp failure the memory of control logic unit 23 is latched indicating a primary lamp fault. When the primary lamp operates correctly, a green LED 22 is operated and under a fault condition a red LED 21 is operated. When the fault condition is latched into memory in the control logic unit 23, the lamp drive 24 operates relay RLB 26 switching all the lamp connections through output 28 to the secondary lamp. Just prior to RLB 26 operating, the control gear drive 20 removes power from relay RLA 19 to disconnect the supply 30 to the control gear 12, to prevent relay RLB 26 switching between lamps whilst power is supplied thereto. After a fixed time relay RLA 19 is supplied power in order to reapply power to the control gear 12 which in turn causes a secondary lamp 15 to operate.

In order to test the secondary lamp 15, there is a test feature 50 which on operation will cause the control unit 23 to operate relay RLB 26. A further option is to provide battery back up 25 in order to maintain memory when power is removed from the control logic unit 23. This memory can be reset by a push button switch 51.

Figure 4 shows the block diagram of an electronic control unit similar to that of Figure 3, but adapted for multiple primary lamp operation.

The primary lamp sensor 16 shown in Figure 5 and comprises a spring clip 31 which can be fitted onto a tubular lamp and positioned anywhere along the length of a lamp. The printed circuit board 34 is screwed 32 to the spring clip 31. The LDR sensor 33 is mounted onto the printed circuit board 34 and connected to the control systems through wires 35. The LDR sensor is surrounded by a shroud 36 to minimise light input from

other lamps and general ambient lighting within the sign or luminaire.

Figures 6 and 7 show how the primary lamp 14 can be monitored by a voltage sensor 37 or a current sensor 38 connected across the lamp or in series with the lamp, respectively, to measure if the lamp is operating correctly.

Figure 8 shows that the primary lamp 14 can be monitored by a temperature sensor 39 mounted to an appropriate position to determine that the lamp is operating correctly.

If a sign is controlled by a timer or photocell then all lamps will be switched off during daytime. As shown in Figure 9, status indicators can be displayed on the outside of a sign 40 in the form of green and red LEDs 41, 42 to show the status of lamps. If all the primary lamps 14 are working correctly then all the green LEDs 41 will be indicating. If however, a primary lamp 14 has failed then the appropriate red LED 42 will indicate a primary lamp 14 failure. The numbers of illuminated red LEDs 42 will indicate how many primary lamps need replacing. This system will allow a sign to be monitored on a routine basis, for example by someone changing a poster on the sign.

Figure 10 shows a sign 40 in which lamps can be remotely monitored using a radio transmitter system 43.

Figure 11 shows a sign 40 in which lamps can be remotely monitored using an infra-red transmitter 44, whilst Figure 12 shows a sign 40 where lamps can be remotely monitored via a modem 45 connected by cable 46 to the phone network.

A microprocessor based control system is shown in Figure 13. The microprocessor control unit 47 can carry out a range of tasks such as lamp monitoring, regular testing of secondary lamps, and/or monitoring of lamp running times. It may also store an algorithm for detecting and predicting lamp failures on the basis of information received from a range of sensors. This system can also link via a modem 45 for full remote monitoring and control.

Figure 14 shows a system for use in signs or luminaires where high reliability is required. It includes one primary lamp 14 and three secondary lamps 15. When the primary lamp 14 fails,

the new secondary lamp 15 becomes a primary lamp with its own LDR sensor 16. This unit would maintain full function after up to three lamp failures. It will be appreciated that the only limiting factors on the numbers of secondary lamps are the mechanical and economical constraints on fitting multiple lamps.

Figures 15, 16 and 17 show unitary lamp assemblies comprising two, three and four lamps, respectively, and corresponding cross-sectional views are shown in Figures 15A, 16A and 17A. Each unit includes a primary lamp 14 and one or more secondary lamps 15. The lamp control circuitry described above, including the sensor(s) 16, is provided in the end caps 50 of the assemblies together with the lamp input terminals (not shown). The multiple lamp assemblies of Figures 16 and 17 are configured to switch power to succeeding secondary lamps 15 as described in relation to the circuit of Figure 14.

A standard fluorescent lamp size is "T8", which has a diameter of approximately 25mm. When utilising fluorescent lamps in a unitary lamp assembly as illustrated in Figures 15 to 17, it may be preferably to utilise a smaller lamp such as a "T5" lamp, which has a diameter of approximately 18mm. Thus the multiple lamp assembly can be made more compact.

The reliability of a sign or luminaire may be improved further by providing primary and secondary control gear 12 as well as primary and secondary lamps. This feature would be particularly useful where complex electronic control gear is used, which may be subject to failure under certain conditions.

It will be appreciated that this invention is applicable to any type of light source or control equipment for its operation, whether used in signs, luminaires or other products.

CLAIMS

1 Lamp control circuitry comprising input means for connection to a power supply, control means, first and second output means for connection to first and second lamps, respectively, and a sensor for monitoring said first lamp, such that when or after the sensor detects that said first lamp is exhibiting a predetermined characteristic or a combination of predetermined characteristics indicative of substantial deterioration or failure, the control means switches power output from the first to the second output means.

2 Control circuitry of Claim 1 wherein a predetermined characteristic detected by the sensor is the light output of said first lamp falling below a threshold level.

3 Control circuitry of Claim 2 wherein the sensor is a light dependent resistor.

4 Control circuitry of Claim 2 or Claim 3 wherein a shroud is provided around the sensor to substantially ensure that light incident on the sensor is only from said first lamp.

5 Control circuitry of any of Claims 2 to 4 wherein means are provided for releasably attaching the sensor to said first lamp.

6 Control circuitry of any preceding claim wherein a predetermined characteristic is a predetermined voltage level across the terminals of said first lamp.

7 Control circuitry of any preceding claim wherein a predetermined characteristic is a predetermined level of the current drawn by the said first lamp.

8 Control circuitry of any preceding claim wherein a predetermined characteristic is a predetermined temperature threshold for said first lamp.

9 Control circuitry of any preceding claim wherein said first lamp is a fluorescent lamp, and a predetermined characteristic is a predetermined degree of blackening on the inner surface of the lamp adjacent one of its electrodes.

10 Control circuitry of any preceding claim including a status indicator to show when power output has been switched from the first to the second output means.

11 Control circuitry of any Claims 1 to 9 wherein status information is transmissible from the control means to a monitoring station.

12 Control circuitry of any preceding claim comprising separate sets of electrical components for controlling the current fed to each lamp, power being deliverable to each lamp via the respective set.

13 Control circuitry of any preceding claim including three or more output means for connection to respective lamps, and sensors for monitoring all but the last of said lamps, the control means being operable to switch power from one output means to the next after the sensor associated with the lamp connected to the one output means detects that it is exhibiting a predetermined characteristic or a combination of predetermined characteristics.

14 A unitary lamp assembly comprising first and second lamps fixed together and connectable to the first and second output means of control circuitry of any preceding claim.

15 A unitary lamp assembly comprising control circuitry of any of Claims 1 to 13, and first and second lamps connected to first and second output means, respectively of the circuitry.

16 Lamp control circuitry substantially as described herein with reference to the accompanying drawings.

17 A unitary lamp assembly substantially as described herein with reference to the accompanying drawings.

AMENDMENTS TO THE CLAIMS HAVE BEEN FILED AS FOLLOWS:

1 Lamp control circuitry comprising input means for connection to a power supply, control means, first and second output means for connection to first and second lamps, respectively, and a sensor for monitoring said first lamp, said first lamp being a fluorescent lamp, such that when or after the sensor detects that said first lamp is exhibiting a predetermined characteristic or a combination of predetermined characteristics indicative of substantial deterioration or failure, the, or one of the predetermined characteristics being a predetermined degree of blackening on the inner surface of first lamp adjacent one of its electrodes, the control means switches power output from the first to the second output means.

2 Control circuitry of Claim 1 wherein one of the combination of predetermined characteristics detected by the sensor is the light output of said first lamp falling below a threshold level.

3 Control circuitry of Claim 2 wherein the sensor is a light dependent resistor.

4 Control circuitry of Claim 2 or Claim 3 wherein a shroud is provided around the sensor to substantially ensure that light incident on the sensor is only from said first lamp.

5 Control circuitry of any of Claims 2 to 4 wherein means are provided for releasably attaching the sensor to said first lamp.

6 Control circuitry of any preceding claim wherein one of the combination of predetermined characteristics is a predetermined voltage level across the terminals of said first lamp.

7 Control circuitry of any preceding claim wherein one of the combination of predetermined characteristics is a predetermined level of the current drawn by the said first lamp.

8 Control circuitry of any preceding claim wherein one of the combination of predetermined characteristics is a predetermined temperature threshold for said first lamp.

9 Control circuitry of any preceding claim including a status indicator to show when power output has been switched from the first to the second output means.

10 Control circuitry of any Claims 1 to 8 wherein status information is transmissible from the control means to a monitoring station.

11 Control circuitry of any preceding claim comprising separate sets of electrical components for controlling the current fed to each lamp, power being deliverable to each lamp via the respective set.

12 Control circuitry of any preceding claim including three or more output means for connection to respective lamps, and sensors for monitoring all but the last of said lamps, the control means being operable to switch power from one output means to the next after the sensor associated with the lamp connected to the one output means detects that it is exhibiting a predetermined characteristic or a combination of predetermined characteristics.

13 A combination of control circuitry of any preceding claim and a unitary lamp assembly comprising first and second lamps fixed together and connected to the first and second output means of the control circuitry.

14 A unitary lamp assembly comprising control circuitry of any of Claims 1 to 12, and first and second lamps connected to first and second output means, respectively of the circuitry.

15 Lamp control circuitry substantially as described herein with reference to the accompanying drawings.

The Patent Office

INVESTOR IN PEOPLE

14

Application No: GB 9818513.5 **Examiner:** M J Billing
Claims searched: 1 to 13 **Date of search:** 24 June 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F4R RGA; G1A AMSV, AMSX; H2H HLL2, HLV5.

Int Cl (Ed.6): H05B 37/03, 37/04, 39/10, 41/46.

Other: ONLINE - EPODOC, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2287309A	(FOREST CITY SIGNS) - Figs.2,3; page 4 line 13 to page 5 line 14, page 12 lines 19-29	1-3,7,8, 12,13 at least
X	GB2110486A	(M.L.ENGINEERING) - Figs.2,3,5; Abstract, page 4 lines 79-82	1,7,10,11 at least
X	EP0396791A1	(RENCOTUOTE) - Fig.1; column 4 lines 26-44	1,6,12 at least
X	EP0239653A1	(TELETTRA) - Figs.1-3; Abstract, column 4 lines 11-40, column 5 lines 3-7	1,10,11 at least
X	EP0196249A1	(AUGIER) - Figs.3,4; Abstract	1,2,4, at least
X	US4527095	(HERRING) - Figs.3,4; Abstract	1,6,7,12, 13 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

BNSDOCID <GB... 2341017A I >

The Patent Office

INVESTOR IN PEOPLE

Application No:	GB 9818513.5	**Examiner:**	Huw Jones
Claims searched:	14	**Date of search:**	21 September 1999

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F4R - RMR, RL

Int Cl (Ed.6): F21S - 3/00, 3/02
F21V - 19/00, 21/00
H01J - 61/02
H05B - 39/10

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2175386 A	(TIVADAR) - see fig. 6	14
X	GB1101523 A	(UNDERWRITERS) - see fig. 1	14
X	US5570947 A	(FELLAND) - see figs. 2&3	14
X	US5349508 A	(KARBAF) - see fig. 2	14
X	US5221139 A	(BELFER) - see fig. 1	14
X	US5088015 A	(BAGGIO) - see fig. 3	14
X	US4906888 A	(PHILIPS) - see fig. 1	14
X	US3999099 A	(MORRIS) - see fig. 2	14
X	US3790846 A	(HERION) - see fig. 1	14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.